

# Charged Particle Distributions in Central Au+Au Collisions at $\sqrt{s} = 130$ GeV

*P. Jacobs (LBNL); S. Margetis (Kent State); M. Calderon, T. Ullrich and Z. Xu (Yale);  
and the STAR Collaboration*

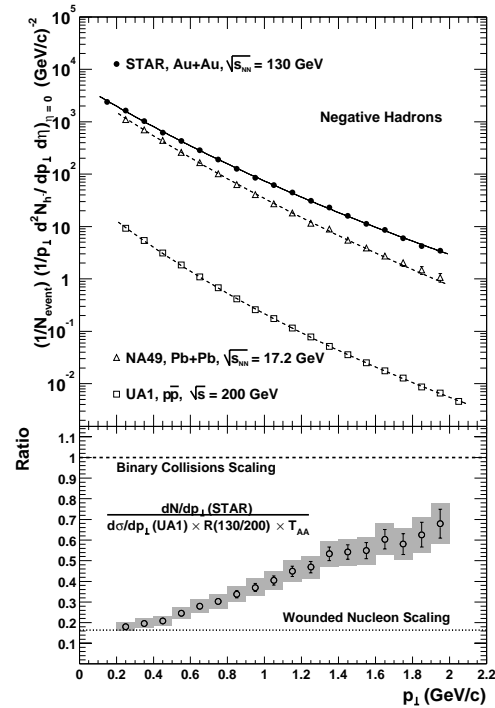
Collisions of high energy heavy ions at RHIC produce thousands of hadrons in the final state. Strictly speaking, these hadrons are messengers from the final freeze-out stage of the collision, but they also transmit information from the earlier, hotter and denser stages: energy density, entropy production, and the generation of flow.

We present the first measurement with the STAR detector of inclusive distributions of negative hadrons from the 5% most central Au+Au collisions at  $\sqrt{s} = 130$  GeV.  $\bar{p}+p$  collisions at 200 GeV (UA1[1]) and Pb+Pb collisions at 17 GeV (NA49[2]) are used for comparison, to reveal potentially new features of heavy ion collisions at RHIC.

The upper panel of the figure shows the transverse momentum ( $p_{\perp}$ ) spectrum of negative hadrons near midrapidity for STAR, NA49 and UA1, together with power-law fits. From the fit,  $\langle p_{\perp} \rangle$  for STAR is  $516 \pm 12$  MeV/c, compared with  $429 \pm 3$  MeV/c for NA49 and  $392 \pm 3$  MeV/c for UA1. The spectrum is harder for STAR, reflecting the combined effects of hard scattering processes and radial flow. Integrating the spectrum, STAR observes an increase in particle production per participating nucleon of a factor 30-40% relative to UA1 and NA49.

The lower panel shows the ratio of the STAR and UA1 spectra, scaled by factors accounting for the energy difference and the nuclear geometry. The ratio would be unity if a central Au+Au collision were a simple convolution of binary nucleon-nucleon collisions. “Wounded Nucleon scaling” has been observed at lower energies[2], where the produced multiplicity is proportional to the number of incoming nucleons participating in the collision. For the STAR data, the Wounded Nucleon scaling is observed at the low-

est  $p_{\perp}$ , but the ratio climbs rapidly with  $p_{\perp}$ . There are several physical reasons for this: initial state scattering of incoming partons (“Cronin” effect), the onset of hard scattering, and radial flow in the final state. At higher  $p_{\perp}$ , shadowing and jet quenching may also come into play. Disentangling these effects will require measurements at high  $p_{\perp}$  and a systematic study of impact parameter and system mass dependence.



## References

- [1] C. Albajar et al., Nucl. Phys. B355, 261 (1990)
- [2] H. Appelshäuser et al., Phys. Rev. Lett. 82, 2471 (1999)